

MODELLING AWARENESS OF DIABETES
MELLITUS: CASE STUDY AT TWO PUBLIC
HEALTH CENTRES

HUMAIRA' BINTI ABDUL LATIF

DOCTOR OF PHILOSOPHY

UNIVERSITI MALAYSIA PAHANG



SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy.

(Supervisor's Signature)

Full Name : DR. MOHD RASHID BIN AB HAMID

Position : ASSOCIATE PROFESSOR

Date :



STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

(Student's Signature)

Full Name : HUMAIRA' BINTI ABDUL LATIF

ID Number : PSS14002

Date :

MODELLING AWARENESS OF DIABETES MELLITUS: CASE STUDY AT TWO
PUBLIC HEALTH CENTRES

HUMAIRA' BINTI ABDUL LATIF

Thesis submitted in fulfillment of the requirements
for the award of the degree of
Doctor of Philosophy

Centre for Mathematical Sciences
UNIVERSITI MALAYSIA PAHANG

NOVEMBER 2019

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim,

Alhamdulillah, first of all, I am utterly grateful to Allah S.W.T. The Almighty for His grace and blessing which have given me the courage and the will to complete the writing up of this thesis entitled, “Modelling Awareness of Diabetes Mellitus: Case Study at Two Public Health Centres” in time.

I would like to express my appreciation to my supervisor, Associate Professor Dr. Mohd Rashid bin Ab Hamid, for his unfailing ideas, guidance, encouragement, enthusiasm, and motivation throughout this doctoral journey. Only Allah can reward his kind deeds. May Allah bestow His blessings upon him and his family. Thank you once again.

I would also like to express my sincere appreciation to my father, Abdul Latif bin Jusoh, and my mother, Zalma binti Abdul Hamid, who have always encouraged and supported me from the very beginning since I first started this study until the final touches of this thesis as well as for the constant prayers to ensure the successful completion of my PhD at UMP.

I am also indebted to the Ministry of Higher Education Malaysia for the financial assistance provided through MyPhD and Universiti Malaysia Pahang (UMP) for awarding the research grant Vote No. RDU130612.

Finally, thanks to all those involved who have helped me either directly or indirectly throughout my doctoral study. Their kindness and support will always be remembered.

ABSTRACT

Diabetes is an increasingly growing health concern in Malaysia and the increase in the number of diabetics is worrying. Diabetes is a chronic disease in which the human body is unable to produce or utilize insulin. Insulin is a type of hormone needed to convert sugar, starches and other food into energy needed for daily life. The true cause of diabetes is still unknown, though genetics and the environment play an important role. Every year, the Ministry of Health launches a campaign to create awareness about the effects of diabetes. However, the prevalence of diabetes in Malaysia, especially Type 2, has increased to the epidemic. Therefore, this study proposes a conceptual model to study factors that may create awareness among the public in order to avoid the disease. This model was tested using an exploration approach through statistical modelling techniques to validate the hypothesised model which involved latent constructs such as knowledge about diabetes, attitude towards the disease, the environment surrounding it, symptoms and awareness of diabetes itself. A total of ten hypotheses were put forward to examine the relationships between the five constructs in the hypothesised model. A cross-sectional survey was used in this study, and it was carried out at two health clinics of the Ministry of Health Malaysia (MoH) in Pahang. A total of 441 adults were involved while attending the outpatient department at Klinik Kesihatan Paya Besar and Klinik Kesihatan Padang Rumbia. The sampling used convenience sampling that was conducted from 1 September 2015 to 15 October 2015. Partial Least Squares-Structural Equation Modelling (PLS-SEM) technique was used to test the hypothesised model and examine the relationships between the constructs in the Diabetes Mellitus Awareness Model (DMAM). The results showed that the knowledge had a significant impact on the environment, attitude, and awareness. Meanwhile, environment significantly influenced the attitude whereas attitude had a significant relationship with awareness. However, the findings also indicated that the environment had no significant relationship with awareness and the environment did not have any significant effect on symptoms of diabetes mellitus. The causal relationship between attitude with symptoms, and the relationship between symptom and awareness were also not significant. In general, this study concludes with the relationships that are both statistically significant and insignificant, therefore, due care should be paid and given a due attention by the authorities in order to jumpstart in raising awareness of diabetes mellitus among public. Although the sampling is limited to population in Kuantan Pahang only, but the results of the study could be beneficial for most relevant authorities especially the Ministry of Health to take further actions for improving the level of awareness among Malaysians.

ABSTRAK

Diabetes merupakan masalah perubatan yang semakin berleluasa di Malaysia dan peningkatan pesakit kencing manis di Malaysia adalah membimbangkan. Kencing manis adalah penyakit kronik di mana badan tidak dapat menghasilkan atau menggunakan insulin dengan sempurna. Insulin adalah satu jenis hormon yang diperlukan untuk menukar gula, kanji dan makanan lain kepada tenaga yang diperlukan untuk kehidupan harian. Punca sebenar diabetes masih tidak diketahui, walaupun genetik dan persekitaran memainkan peranan yang penting. Setiap tahun, Kementerian Kesihatan melancarkan kempen untuk mewujudkan kesedaran mengenai kesan diabetes. Namun, kelaziman penyakit kencing manis di Malaysia, terutamanya yang Jenis 2, telah meningkat kepada wabak. Oleh itu, kajian ini mencadangkan model konseptual untuk mengkaji faktor-faktor yang boleh mewujudkan kesedaran di kalangan orang ramai di Malaysia untuk mengelakkan dari penyakit itu. Model ini diuji menggunakan pendekatan penerokaan melalui teknik pemodelan statistik bagi mengesahkan model hipotesis yang terdiri daripada beberapa faktor terpendam, iaitu pengetahuan tentang diabetes, sikap terhadap penyakit, persekitaran, gejala dan kesedaran terhadap penyakit kencing manis. Sebanyak sepuluh hipotesis telah dicadangkan untuk menguji hubungan di antara lima indikator di dalam model hipotesis. Kaedah tinjauan keratan rentas digunakan dalam kajian ini dan ia telah dijalankan di dua buah klinik kesihatan Kementerian Kesihatan Malaysia (KKM) di Pahang. Sebanyak 441 sampel mudah orang dewasa yang menghadiri jabatan pesakit luar di Klinik Kesihatan Paya Besar dan Klinik Kesihatan Padang Rumbia. Sampel yang digunakan ialah persampelan kemudahan yang dijalankan dari 1 September 2015 hingga 15 Oktober 2015. Teknik kuasa dua terkecil pemodelan persamaan struktur (PLS-SEM) telah dijalankan untuk menguji model hipotesis dan mengkaji hubungan antara konstruk dalam Model Kesedaran Diabetes Mellitus (DMAM). Dapatan kajian menunjukkan bahawa pengetahuan memberi kesan yang signifikan kepada persekitaran, sikap dan kesedaran. Begitu juga, persekitaran mempengaruhi secara signifikan terhadap sikap, dan seterusnya, sikap mempunyai hubungan yang signifikan kepada kesedaran. Namun begitu, keputusan kajian juga mendapati bahawa terdapat hubungan yang tidak signifikan antara persekitaran terhadap kesedaran dan persekitaran terhadap gejala penyakit kencing manis. Juga, hubungan bersebab antara sikap dengan gejala penyakit kencing manis dan hubungan antara gejala penyakit kencing manis terhadap kesedaran turut tidak signifikan. Secara keseluruhannya, kajian ini menyimpulkan kedua-dua perkaitan-perkaitannya yang statistik secara signifikan dan tidak signifikan. Oleh itu, hal yang sedemikian harus diambil perhatian yang sewajarnya oleh pihak yang berkuasa agar dapat meningkatkan kesedaran penyakit kencing manis di kalangan orang ramai. Walaupun pensampelan yang terhad kepada populasi di Kuantan Pahang sahaja, tetapi hasil kajian itu boleh memberi manfaat kepada pihak berkuasa yang berkaitan terutamanya Kementerian Kesihatan untuk mengambil tindakan selanjutnya untuk meningkatkan tahap kesedaran di kalangan rakyat Malaysia.

TABLE OF CONTENT

DECLARATION	
TITLE PAGE	
ACKNOWLEDGEMENTS	ii
ABSTRACT	iii
ABSTRAK	iv
TABLE OF CONTENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xii
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Background of the study	2
1.3 Problem statement	6
1.4 Research questions	9
1.5 Objectives of the Study	10
1.6 Significance of the Study	10
1.7 The Scope of the Study and Its Limitations	13
1.8 Definition of terms	13
1.9 Structure of the Thesis	14
CHAPTER 2 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK	16
2.1 Introduction	16
2.2 Critical diseases in Malaysia	16
2.3 Trends of diabetics in Malaysia	20

2.4	Diabetes mellitus awareness	21
2.5	Previous Studies on Diabetes Melitus Awareness	22
2.6	Knowledge about Diabetes	25
2.7	Attitude towards diabetes mellitus	26
2.8	Environment towards diabetes mellitus	28
2.9	Symptoms of diabetes mellitus	29
2.10	Underpinning Theories for Conceptual Framework	30
	2.10.1 Knowledge, Attitudes and Practice (KAP) theory	30
	2.10.2 Social Cognitive Theory (SCT)	31
2.11	Conceptual framework	32
	2.11.1 Hypothesis development	33
2.12	Summary	38
CHAPTER 3 RESEARCH METHODOLOGY		39
3.1	Introduction	39
3.2	Types of research	39
3.3	Sampling and population	40
3.4	Research instrument process	41
	3.4.1 Scale rating	42
	3.4.2 Measurement based on Diabetes Mellitus Awareness Model (DMAM)	43
3.5	Pre-Test	48
	3.5.1 Content validity	49
	3.5.2 Reliability	50
3.6	Data Collection	51
3.7	Statistical analysis techniques	51

3.7.1	Exploratory Data Analysis (EDA)	51
3.7.2	Descriptive analysis	53
3.8	Structural equation modelling (SEM)	53
3.8.1	Confirmatory factor analysis (CFA)	55
3.8.2	Partial least squares structural equation modelling (PLS-SEM)	57
3.8.3	Measurement model (outer model) assessment	58
3.8.4	Structural model (inner model) assessment	62
3.9	Summary	64
CHAPTER 4 DATA ANALYSIS AND RESULTS		65
4.1	Introduction	65
4.2	Profile of Respondents: Demographic Data Analysis	65
4.3	Exploratory data analysis (EDA)	68
4.3.1	Outliers analysis	69
4.3.2	Common methods variance	69
4.3.3	Data normality	70
4.3.4	Multicollinearity	71
4.4	Descriptive analysis	72
4.5	Partial Least Squares-Structural Equation Modelling	81
4.5.1	Assessment of outer model	82
4.5.2	Indicator reliability	83
4.5.3	Construct validity	84
4.5.4	Convergent validity	84
4.5.5	Discriminant validity assessment	87
4.5.6	Assessment of inner model / structural model	88
4.6	Summary	92

CHAPTER 5 DISCUSSIONS AND CONCLUSIONS	93
5.1 Introduction	93
5.2 Discussion of findings	93
5.2.1 The relationship between knowledge with attitude, environment, symptoms and awareness	94
5.2.2 The relationship between attitude with symptoms and awareness	95
5.2.3 The relationship between environment with attitude, symptoms and awareness	96
5.2.4 The relationship between symptoms and awareness	97
5.3 Diabetes Mellitus Awareness Model (DMAM) in Malaysia	98
5.4 Implications and contributions of study	101
5.5 Recommendation	103
5.6 Limitation of research studies	104
5.7 Conclusions	104
REFERENCES	105
APPENDIX A QUESTIONNAIRE	123
APPENDIX B HARMAN’S SINGLE FACTOR TEST	133
APPENDIX C TRANSLATION VALIDATION FORM	134

LIST OF TABLES

Table 3.1	Diabetes Mellitus Awareness Model (DMAM) Questionnaire	44
Table 3.2(a)	Items measuring the construct of DM Knowledge: general knowledge	45
Table 3.2(b)	Items measuring the construct of DM Knowledge: risk factor	45
Table 3.2(c)	Items measuring the construct of DM Knowledge: prevention	46
Table 3.2(d)	Items measuring the construct of DM Knowledge: complication	46
Table 3.2(e)	Items measuring the construct of DM Knowledge: treatment	46
Table 3.3	Items measuring the construct of Attitude	47
Table 3.4	Items measuring the construct of Environment	47
Table 3.5	Items measuring the construct of DM Symptoms	47
Table 3.6	Items measuring the construct of DM Awareness	48
Table 4.1	Respondent profile (n = 441)	67
Table 4.2	Common Method Variance	70
Table 4.3	Normality Test	71
Table 4.4	Correlation among Construct	72
Table 4.5	Variance Inflation Factor	72
Table 4.6(a)	Descriptive Statistics for Knowledge: General Knowledge of DM	73
Table 4.6(b)	Descriptive Statistics for Knowledge: Risk Factors of DM	74
Table 4.6(c)	Descriptive Statistics for Knowledge: Prevention of DM	75
Table 4.6(d)	Descriptive Statistics for Knowledge: Complications of DM	75
Table 4.6(e)	Descriptive Statistics for Knowledge: Analysis of the Treatment of DM	76
Table 4.6(f)	Mean Scores of Indicators Measuring Knowledge	76
Table 4.7	Descriptive statistics for attitude	77
Table 4.8	Descriptive statistics for environment	78

Table 4.9	Descriptive Statistics for Symptoms of DM	79
Table 4.10	Descriptive statistics for awareness	80
Table 4.11	Indices construct reliability	81
Table 4.12	Loadings and cross loadings examination	82
Table 4.13	Outer model assessment	83
Table 4.14	Discriminant validity (Fornell and Larcker, 1981)	87
Table 4.15	HTMT results	87
Table 4.16	Hypotheses testing	88
Table 4.17	Effect size f^2 of knowledge and environment on attitude	91
Table 4.18	Effect size, f^2 of symptom	91
Table 4.19	Effect size, f^2 of awareness	91

LIST OF FIGURES

Figure 1.1	Trends and projections of burden of diabetes in Malaysia by 2020	7
Figure 2.1	Conceptual framework for Diabetics Mellitus Awareness Model	32
Figure 3.1	Research process	42
Figure 3.2	Two indications of Likert scales used in the present study	43
Figure 4.1	Source of information of diabetes mellitus	68
Figure 4.2	Assessment of outer model	85
Figure 4.3	Bootstrapping result	86
Figure 4.4	Quality criteria R square	90

LIST OF ABBREVIATIONS

DM	Diabetes mellitus
GDM	Gestational diabetes mellitus
NCD	Non-communicable disease
IDDM	Insulin-dependent diabetes mellitus
NIDDM	Non-insulin dependent diabetes mellitus
WHO	World Health Organization
NHMS	National Health and Morbidity Survey
MOH	Ministry of Health
DMAM	Diabetics Mellitus Awareness Model
SEM	Structural equation modelling
PLS-SEM	Partial least squares structural equation modelling
KAP	Knowledge, Attitudes, and Practice
SCT	Social Cognitive Theory
EDA	Exploratory data analysis
CMV	Common method variance
AVE	Average variance extracted
CR	Composite reliability
CFA	Confirmatory factor analysis
HTMT	Heterotrait-monotrait
VIF	Variance inflation factor
SPSS	Statistical Package for Social Science
SBPWM	Simple Boost Pulse Width Modulation
ZSI	Z source inverter

REFERENCES

- Abegunde, D.O., Mathers, C.D., Adam, T., Ortegon, M. & Strong, K. (2007). The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet*. 370(9603): 1929–38.
- Abu Bakar, M. (2018). Melayu paling ramai tidak peduli penyakit diabetes. *Utusan*. 29 Oktober: 4.
- Ahmad Makinuddin, A. & Ali, O. (2000). Pengetahuan, Sikap dan Amalan Tentang Kanser Serviks di Kalangan Bidan, Jururawat Desa dan Jururawat Masyarakat. *Akademika*, 56(Januari), 107-119.
- Ahmad, S. (2012). Disiplin Diet. *Berita Harian*. 22 January: 1-4.
- Al-Dahan, S. M., Albaik, M., Alomran, Y., Aldahan, F. & Albaik, S. (2013). Awareness and Knowledge of Diabetes among Al-Wazarat Family Medicine Health Center Attendants. *American Journal of Research Communication*. 1(12): 104-130.
- Al-Khawaldeh, O.A. & Al-Jaradeen, N. (2013). Diabetes awareness and diabetes risk reduction behaviors among attendance of primary healthcare centers. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 7: 172–178.
- Al-Naggar, R.A., Bobryshev, Y.V. & Mohd Noor, N.A. (2013). Lifestyle Practice among Malaysian University Students. *Asian Pacific Journal of Cancer Prevention*. 14(3): 1895-1903.
- Al-Sarayra, L. & Khalidi, R.S. (2012). Awareness and Knowledge about Diabetes Mellitus among Students at Al-Balqa' Applied University. *Pakistan Journal of Nutrition*. 11(11): 1023-1028.
- Altun, H.K. & Keser, L. (2017). Assessment of Eating Attitude Behaviours and Obsessive-Compulsive Symptoms of a Group of University Students: A Pilot Study from Turkey. *Journal of Nutritional Medicine and Diet Care*. 3(1): 1-5.
- Alzghoul, B.I. & Chew Abdullah, N.A. (2015). Psychosocial Theories and Pain Management Practices: A Review of Empirical Research. *Mediterranean Journal of Social Sciences*. 6(6): 60-67.
- American Diabetes Association. (2012). Standards of medical care in diabetes. *Diabetes Care*. 35(1): S11–63.
- American Diabetes Association. (2004). Screening for type 2 diabetes. *Diabetes Care*. 27(suppl 1): S11–S14.
- Amin, L., Mahadi, Z., Ibrahim, R., Yaacob, M. & Nasir, Z. (2012). The effectiveness of the ‘environment & health’ course in increasing students’ awareness & knowledge on environmental health issues. *Procedia - Social and Behavioral Sciences*. 59: 77 – 84.

- Aminrad, Z., Sayed Zakariya, S.Z., Hadi, A.S. & Sakari, M. (2013). Relationship Between Awareness, Knowledge and Attitudes Towards Environmental Education Among Secondary School Students in Malaysia. *World Applied Sciences Journal*. 22(9): 1326-1333.
- Anderson, G. (1998). *Fundamentals of Educational Research*. London: Falmer Press.
- Arcury, A.T. (1990). Environmental Attitude and Environmental Knowledge. *Human Organization*. 49(4): 300-304.
- Ard, J.D. & Svetkey, L.P. (2005). Diet and blood pressure: applying the evidence to clinical practice. *American Heart Journal*. 149: 804–12.
- Ashraff, S., M Siddiqui & T. Carline, (2013). The Psychosocial Impact of Diabetes in Adolescents: A Review. *Oman Medical Journal*. 28(3): 159-162.
- Ayyagari, P., Grossman, D. & Sloan, F. (2011). Education and health: evidence on adults with diabetes. *Int J Health Care Finance Econ*. 11: 35–54.
- Bagherniya, M., Taghipour, A., Sharma, M., Sahebkar, A., Contento, I.R., Keshavarz, S.A., Darani, F.M. & Safarian, M. (2018). Obesity intervention programs among adolescents using social cognitive theory: a systematic literature review. *Health Education Research*. 33(1): 26-39.
- Bagozzi, R. P., Yi, Y. & Phillips, L. W. (1991). Assessing construct validity in organizational research. *Administrative Science Quarterly*. p. 421–458.
- Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Social and Clinical Psychology*. 4(3): 359-373.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman.
- Baptiste-Roberts, K.B., Gary, T.L., Beckles, G.L.A, Gregg, E.W., Owens, M., Porterfield, D. & Engelgau, M.M. (2007). Family History of Diabetes, Awareness of Risk Factors, and Health Behaviors Among African Americans. *American Journal of Public Health*. 97(5): 907-912.
- Baradaran, H. & Jones, K. (2004). Assessing the knowledge, attitude and understanding of type 2 diabetes amongst ethnic groups in Glasgow, Scotland. *Practical Diabetes International*. 21(4): 143-148.
- Baranowski, T., Cullen, K.W., Nicklas, T., Thompson, D. & Baranowski, J. (2003). Are current health behavioral change models helpful in guiding prevention of weight gain efforts? *Obes Res*. 11:23S–43S.
- Barclay D., Higgins C. & Thompson R. (1995). The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration. *Technology Studies* 2(2): 285-309.
- Barua, A., Konana, P., Whinston, A.B. & Yin, F. (2004). An empirical investigation of net-enabled business value. *MIS Quarterly* 28(4): 585-620.

- Baumgartner, H. & Homburg, C. (1996) Applications of structural equation modeling in marketing and consumer research: A review. *International Journal of Research in Marketing* 13(1): 139–161.
- Beaser, R.S. & J.V.C. Hill, (1995). The Joslin Guide to Diabetes: A Program for Managing Your Treatment. Simon and Schuster, New York.
- Bergkvist, L. & Rossiter, J.R. (2007) The predictive validity of multiple-item versus single-item measures of the same constructs. *Journal of Marketing Research* 44(2): 175–184.
- Berita Harian. (2012). Peningkatan penghidap diabetes membimbangkan. 22 Jun 2012.
- Berita Harian. (2013). Hakikat kemanisan hidup. Ruangan sihat. Ms 14-15. 6 Jan 2013.
- Bernama. 2012. Peningkatan penghidap diabetes membimbangkan. *Berita Harian*. 22 June: 1-2.
- Binhemd, T.A. (1992). Diabetes mellitus: knowledge, attitude, practice and their relation to diabetes control in female diabetics. *Ann Saudi Med*. 12(3):247-251.
- Bollen, K.A. (1989). *Structural Equations with Latent Variables*. New York: John Wiley & Sons.
- Bradley, J.C., Waliczek, T.M. & Zajicek, J.M. (1999). Relationship Between Environmental Knowledge and Environmental Attitude of High School Students. *The Journal of Environmental Education*. 30(3): 17-21.
- Byrne, B.M. (2010). *Structural Equation Modeling with AMOS*. Edisi ke-2. New York: Taylor & Francis Group.
- Byrne, B. M. (2009). *Structural equation modelling with AMOS: Basic concepts, applications, and programming*. Routledge.
- Byrne, M., J. Newell, N. Coffey, M.C.O. Hara, D. Cooke & S.F. Dinneen, (2012). Predictors of Quality of Life Gains among People with Type 2 Diabetes Participating in the Dose Adjustment for Normal Eating (DAFNE) Structured Education Programme. *Diabetes Research and Clinical Practice*. 98(2): 243-248.
- Casey, T. & Wilson-Evered, E. (2012). Predicting uptake of technology innovations in online family dispute resolution services: An application and extension of the UTAUT. *Computers in Human Behavior*. 28: 2034-2045.
- Cohen J. (1988). *Statistical power analysis for the behavioral sciences*. Mahwah, NJ: Lawrence Erlbaum.
- Cohen J. (1992). A power primer. *Psychological Bulletin* 112: 155-159.
- Cooper, M.J. (2006). Beliefs and their relationship to eating attitudes and depressive symptoms in men. *Eating Behaviors*. 7: 423–426.

- Chang, S.-J., Van Witteloostuijn, A. & Eden, L. (2010). From the editors: common method variance in international business research. *Journal of International Business Studies*. 41(2): 178–184.
- Chen, J.S. & Tsou, H.T. (2007). Information technology adoption for service innovation practices and competitive advantage: The case of financial firms. *Information Research* 12(3): paper 314.
- Chern J.Y., Wan T.T.H. & Begun J.W. (2002). A Structural Equation Modeling Approach to Examining the Predictive Power of Determinants of Individuals' Health Expenditures. *Journal of Medical Systems*. 26(4): 323-336.
- Chiasson, J.L. (2007). Prevention of Type 2 diabetes: fact or fiction? *Expert Opin Pharmacother*. 8(18): 3147–58.
- Chin, W.W. (1998). Issues and opinion on structural equation modeling. *Management Information System Quarterly* 22(1): 7-16.
- Chin, W.W. (2010). How to write up and report PLS analyses. In *Handbook of Partial Least square: Concept, Methods and Applications in Marketing and Related Fields*. Vincenzo Esposito Vinzi, Wynne W. Chin, Jorg Henseler, and Huiwen Wang, eds., Berlin: Springer, 655-690.
- Chin, W. W., Gopal, A. & Salisbury, W. D. (1997). Advancing the theory of adaptive structuration: The development of a scale to measure faithfulness of appropriation. *Information Systems Research*. 8(4): 342–367.
- Christmas, T. H. (2005). Using partial least squares approach to predict factors that contribute to the impact of E-Folios on Pre-Service teachers' learning. Ph.D. Thesis. Louisiana State University. USA.
- Chua, Y.P. (2009). *Statistik Penyelidikan Lanjutan*. Kuala Lumpur: McGraw Hill Malaysia.
- Courvoisier, D.S., Nussbeck, F.W., Eid, M., Geiser, C. & Cole, D.A. (2008). Analyzing the convergent and discriminant validity of states and traits: Development and applications of multimethod latent state-trait models. *Psychological Assessment* 20(3): 270-280.
- Dabholkar, P.A., Shepherd, C.D. & Thorpe, D.I. (2000). A comprehensive framework for service quality: an investigation of critical conceptual and measurement issues through a longitudinal study. *Journal of Retailing*. 76(2): 139-173.
- David R, Whiting D, Guariguata L, Weil C & Shaw J. (2011). IDF Diabetes Atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Research and Clinical Practice*. 94(3):311–21.
- De Vaus, D. (2005). *Services in social research*. 5th Edition. London: Routledge-Taylor & Francis Group.

- Debono, M. & E. Cachia. (2007). The Impact of Diabetes on Psychological Well Being and Quality of Life. The Role of Patient Education. *Psychology, Health & Medicine*. 12(50): 545-555.
- Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of type 2 diabetes with life-style intervention or metformin. *New England Journal of Medicine* 346: 393-403.
- Diabetes Research and Training Center. (1998). University of Michigan.
- Ding, C.H., Teng, C.L. & Koh, C.N. (2006). Knowledge of Diabetes Mellitus among Diabetic and Non-Diabetic Patients in Klinik Kesihatan Seremban. *Med J Malaysia* 61(4): 399-404.
- DM Newsletter. (2014). *Berita KONTROL*. Selangor Darul Ehsan. Diabetes Malaysia.
- Dunst C.J. & Trivette C.M. (2009). Meta-Analytic Structural Equation Modeling of the Influences of Family-Centered Care on Parent and Child Psychological Health. *International Journal of Pediatrics*. DOI:10.1155/2009/576840.
- Eckert, K. (2012). Impact of Physical Activity and Bodyweight on Health-Related Quality of Life in People with Type 2 Diabetes. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*. 5 (1): 303-311.
- Eckman, K & Walker, R. (2008). Knowledge, Attitudes and Practice (KAP) Survey-summary report for the Duluth Lakeside stormwater reduction project (LSRP). Duluth: Water Resources Center, University of Minnesota.
- Edwards, A. (2013). Diabetics Getting Younger, The Star, November. Retrieved from <http://www.thestar.com.my/News/Nation/2013/11/14/Diabetics-getting-younger-Disease-to-affect-productivity-and-quality-of-life-in-the-long-run.aspx/>
- Fadia, Y.A.M. & El-Sayed, M.M. A. (2012). Health Education Intervention Improves Knowledge, Attitude and Practices of Mothers of Insulin Dependent Diabetes Mellitus. *World Applied Sciences Journal*. 17(11): 1398-1404.
- Farush Khan, F. F. (2014). Diabetes Kian Membimbangkan. *Harian Metro*. 20 January: 1-4.
- Fenwick, E., G. Rees, K. Pesudovs, M. Dirani, Kawasaki, R., Wong, T & Lamoureux, E. (2012). Social and Emotional Impact of Diabetic Retinopathy: A review. *Clinical & Experimental Ophthalmology*. 40(1): 27-38.
- Fezeu, L., Fointama, E., Ngufor, G., Mbeh, G. & Mbanya, J.C. (2010). Diabetes awareness in general population in Cameroon. *Diabetes research and clinical practice*. 90: 312–318.
- Field, A. (2009). *Discovering Statistics using SPSS for Windows*. Third Edition, London-Thousand Oaks-New Delhi: Sage publications.
- Filzmoser, P. (2005). Identification of multivariate outliers: A performance study. *Austrian Journal of Statistics* 34(2): 127-138.

- Foma, M. A., Saidu, Y., Omoleke, S. A. & Jafali, J. (2013). Awareness of diabetes mellitus among diabetic patients in the Gambia: a strong case for health education and promotion. *BMC Public Health*. 13(1124): 1-18.
- Fornell, C. & Larcker, D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18(1): 39-50.
- Fornell, C., Johnson, M.D., Anderson, E.W., Jaesung, C. & Bryant, B.E. (1996). The American customer satisfaction index: Nature, purpose and findings. *Journal of Marketing* 60(4): 7-18.
- García, A. A., Bose, E., Zuñiga, J. A. & Zhang, W. (2019). Mexican Americans' diabetes symptom prevalence, burden, and clusters. *Applied Nursing Research*. 46: 37-42.
- Gefen, D., Straub, D.W. & Boudreau, M. C. (2000). Structural equation modelling and regression: Guidelines for research practice. *Communications of the Association for Information Systems* 4: 1-79.
- Geraldine, A. (2013). Dying early from chronic diseases. *New Straits Times*. 27 September: 1-2.
- Gerbing, D.W. & Anderson, J.C. (1988). An updated paradigm for scale development incorporating unidimensionality and its assessment. *Journal of Marketing Research*. 25(2): 186-192.
- Gholami, R., Sulaiman, A.B., Ramayah, T. & Molla, A. (2013). Senior managers' perception on green information systems (IS) adoption and environmental performance: Results from a field survey. *Information and Management* 50(7): 431-438.
- Givshad, R.D., Saadoldin, S.N. & Esmaily, H. (2015). The Relationship of Perceived Severity of Premenstrual Syndrome with Knowledge, Attitude and Recorded Severity of Syndrom by a Daily Calendar among University Students in Iran. *J Midwifery Reprod Health*. 4(1): 522-529.
- Glanz, K., Lewis, F. M. & Rimer, B. K. (1997). Health behavior and health education: Theory, research, and practice (3rd ed.). San Francisco, CA: Jossey-Bass.
- Goldstein, C.M., Josephson, R., Xie, S. & Hughes, J.W. (2012). Current Perspectives on the Use of Meditation to Reduce Blood Pressure. *International Journal of Hypertension* 2012: 1-11.
- Goz, F., Karaoz, S., Goz, M., Ekiz, S. & Cetin, I. (2007). Effects of the Diabetic Patients' Perceived Environment on their Quality of Life. *Journal of Clinical Nursing*. 16(7): 1353-1360.
- Gotz, O., Liehr-Gobbers, K. & Krafft, M. (2010). Evaluation of structural equation models using the partial least square (PLS) approach. In *Handbook of Partial Least Square: Concept, Methods and Applications in Marketing and Related*

- Fields. Vincenzo Esposito Vinzi, Wyne W. Chin, Jorg henseler and Huiwen Wang, eds., Berlin: springer, 691-711.
- Green, D.T. & Pearson, J.M. (2004). A confirmatory factor analysis of two web site usability instruments. *Proceedings of the Third Annual Workshop on HCI Research in MIS*, hlm. 35 - 39.
- Grewal, R., Cote, J.A. & Baumgartner, H. (2004). Multicollinearity and measurement error in structural equation models: Implications for theory testing. *Marketing Science* 23(4): 519-529.
- Gudergan, S.P., Ringle, C.M., Wende, S. & Will, A. (2008). Confirmatory tetrad analysis in PLS path modeling. *Journal of Business Research* 61: 1238-1249.
- Guidelines Committee. (2003) European Society of Hypertension-European Society guidelines for the management of arterial hypertension. *J Hypertens* 21: 1011–1053.
- Gunay, T., Ulusel, B., Velipasaoglu, S., Unal, B., Ucku, R. & Ozgener, N. (2006). Factors affecting adult knowledge of diabetes in Narlidere Health District, Turkey. *Acta Diabetol* 43: 142–147.
- Gusti Hassan, N.K. (2019). Kerajaan biaya RM2.7 bilion kos diabetes, jantung, kanser. *Sinar Harian*. 14 April: 6.
- Habshah, M. & Azmi, J. (2006). The misuse of statistical techniques in research: An observation and experiences. *Prosiding Seminar Kebangsaan Sains Kuantitatif*.
- Hair J.F., Black W.C., Babin B.J. & Anderson R.E. (2010). *Multivariate Data Analysis*. 7th Ed. Upper Saddle River, New Jersey: Prentice Hall.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Sage Publication: Los Angeles.
- Hair, J., Ringle, C. and Sarstedt, M. (2013). Editorial-Partial Least Squares Structural Equation Modelling: Rigorous Applications, Better Results and Higher Acceptance. *Long Range Planning*. 46 (1-2): 1-12.
- Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *The Journal of Marketing Theory and Practice*. 19(2): 139–152.
- Hamid, N. (2012). Kesedaran pesakit penting. *Berita Harian*. 14 Oktober: 14.
- Hansmann, K.W. & Ringle, C.M. (2005). Enterprise-networks and strategic success – an empirical analysis. Dlm. Theurl, T. & Meyer, E.C. (pnyt.). *Strategies for Cooperation*, hlm. 133-152. Aachen: Shaker.
- Hart, H.E., H.J.G. Bilo, W.K. Redekop, R.P. Stolk, J.H. Assink & B. Meyboom-de Jong. (2003). Quality of Life of Patients with Type I Diabetes Mellitus. *Quality of Life Research*. 12: 1089-1097.

- Hasan A.R. (2012). The Future of Diabetes in Malaysia. Keynote Address: Malaysian Diabetes Educators Society Seminar 2012. Ministry of Health Malaysia. Subang Jaya, Selangor.
- Hashmi, N.R., Manzoor, I. & Daud, S. (2008). Diabetes Mellitus; Awareness among Individuals Attending Out Patient Department of Ghurki Trust Teaching Hospital. *Professional Med J Mar*. 15(1): 96-100.
- Helgeson, V.S. (2003). Environment and Quality of Life. *Quality of Life Research*. 12(1): 25-31.
- Henseler, J., Ringle, C.M. & Sinkovics, R.R. (2009). The use of partial least squares path modeling in international marketing. *Advances in International Marketing* 20: 277–319.
- Herpburn D.A., MacLeod K.M., Deary I.J. & Frier B.M. (1994). Structural Equation Modeling of Symptoms, Awareness and Fear of Hypoglycemia, and Personality in Patients With Insulin-Treated Diabetes. *Diabetes Care*. 17(11): 1273-1280.
- Hjelm, K., Mufunda, E., Nambozi, G. & Kemp, J. (2003). Preparing nurses to face the pandemic of diabetes mellitus: a literature review. *J Adv Nurs*. 41(5): 424–34.
- Hoëbes, K.H. & Matengu, K. (2014). Knowledge and Understanding of Menopause and Menopausal Symptoms: A Namibian Perspective. *International Journal of Health Sciences*. 2(2): 163-183.
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: a review of four recent studies. *Strategic Management Journal*. 20(2): 195–204.
- Inkpen, A.C. & Birkenshaw, J. (1994). International joint ventures and performance: An interorganizational perspective. *International Business Review* 3(3): 201-217.
- Ismail, W.R., Mamat, N.J.Z., Lee, Y.L., Mustafa, Z., Suradi, N.R.M. & Shahabuddin, F.A. (2011). Technology acceptance model for the use of SPIN in UKM. *Proceedings of UMTAS*, hlm. 92-96.
- Jaccard, J., Dittus, P. & Gordon, V. (1996). Maternal correlates of adolescent sexual and contraceptive behavior. *Family Planning Perspectives*. 28: 159–65.
- Ju, L.C., Shahr, S., Yahya, H.M., Ching, T.S., Mohd Nor, N.S., Chuo, L.H, Mohd Zaki, M.F., Salehuddin, D. & Mukhsan, N. (2010). Tahap Pengetahuan Pemakanan dan Kesedaran Kesihatan di Kalangan Pesakit Diabetes Mellitus di Klinik Kesihatan, Cheras, Kuala Lumpur, Malaysia. *Sains Malaysiana*. 39(3): 505–511.
- Kanji, G.K. (1998). Measurement of business excellence. *Total Quality Management* 9(7): 633-643.
- Karuthan, C. (2009). *Structural Equation Modeling using AMOS*. Monograf tidak diterbitkan.

- King, H., Aubert, R.E. & Herman, W.H. (1998). Global burden of diabetes, 1995-2025. *Diabetes Care*. 21(9): 1414-1431.
- Kline, R. B. (2005). *Principles and practice of structural equation modelling*. New York: Guilford press.
- Kline, R.B. (2011). *Principles and Practice of Structural Equation Modeling*. 3rd ed. New York: The Guilford Press.
- Knowler, W.C., Barrett-Connor, E., Fowler, S.E., Hamman, R.F., Lachin, J.M. & Walker, E.A. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*. 346(6): 393–403.
- Kosaka, K., Noda, M. & Kuzuya, T. (2005). Prevention of type 2 diabetes by lifestyle intervention: a Japanese trial in IGT males. *Diabetes Research and Clinical Practice*. 67: 152–62.
- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement* 30: 607-610.
- Kwach B., Ongati O. & Simwa R. (2011). Mathematical Model for Detecting Diabetes in the Blood. *Applied Mathematical Sciences*. 5(6): 279-286.
- Lai, P., S.S. Chua, C.H. Tan & S.P. Chan, (2012). Validation of the Diabetes, Hypertension and Hyperlipidemia (DHL) Knowledge Instrument in Malaysia. *BMC Medical Research Methodology*, 12(1): 18.
- Landon, Megan. (2006). *Environment, Health and Sustainable Development*. England: Open University Press.
- Letchuman, G.R., Wan Nazaimoon, W.M., Wan Mohamad, W.B., Chandran, L.R., Tee, G.H., Jamaiah, H., Isa, M.R., Zanariah, H., Fatanah I. & Ahmad Faudzi Y. (2010). Prevalence of diabetes in Malaysia National Health Morbidity Survey III 2006. *Med J. Malaysia*. 65(3):180-6.
- Lim M.Y. & Liong C.Y. (2010). Analisis terhadap keputusan ujian saringan diabetes menggunakan model regresi logistik. *Prosiding Persidangan Antarabangsa Sains Matematik Kedua (ICMS2010)*. 987-994.
- Live-well Nutraceuticals. (2013). Hakikat Kemanisan Hidup. *Berita Harian*. 6 January: 14.
- Live-well Nutraceuticals. (2013). Kebal Insulin. *Berita Harian*. 6 January: 15.
- Łopatyński J, Mardarowicz G. & Szcześniak G. (2003). A comparative evaluation of waist circumference, waist-to-hip ratio, waist-to-height ratio and body mass index as indicators of impaired glucose tolerance and as risk factors for type-2 diabetes mellitus. *Ann Univ Mariae Curie Skłodowska Med* 58(1): 413–419.
- Luo, M.M., Remus, W. & Chea, S. (2006). Technology acceptance of internet-based information services: An integrated model of TAM and U&G theory.

- Proceedings of the Twelfth Americas Conference on Information Systems*, hlm. 1139-1150.
- Ma, H. (2006). Cholesterol and Human Health. *The Journal of American Science* 2(1): 46-50.
- Malhotra, N.K. (2009). *Basis Marketing Research: A Decision-Making Approach*. 3rd edition, Perason Education: Uppe Saddle River, New Jersey.
- Mashige, K.P., Notshweleka, A., Moodley, S., Rahmtoola, F.H., Sayed, S.B., Singh, S. & Sardiwalla, Z. (2008). An assessment of the level of diabetic patients' knowledge of diabetes mellitus, its complications and management in Durban, South Africa. *The South African Optometrist*. 67(3): 95-105.
- Mehdad S., Hamrani A., El Kari K., El Hamdouchi A., Barakat A. & El Mzibri M. (2012). Body mass index, waist circumference, body fat, fasting blood glucose in a sample of Moroccan adolescents aged 11–17 years. *J NutrMetab* 2012: 510458.
- Metro Ahad. (2012). Galak kesedaran diabetes. Ruanga sihat, ms F6. 9 Disember 2012.
- Middelkoop, B.J.C. & Wal G.V.D. (2004). Culture-specific diabetes care for Surinam South Asians with a low socio-economic position: who benefits. *Patient Educ Couns*. 53:353–358
- Milone, G. (2010). A Mutivariate Strategic Perspective for the Evaluation of Customer Satisfaction in Great Distribution. *Journal of Applied Quantitative Methods*. 302.
- Minhat, H.S. & Hamedon, T.R. (2014). Understanding Towards Diabetes Mellitus among Rural Adult Community in Malaysia. *World Journal of Medical Sciences*. 11(2): 217-221.
- Mingguan Malaysia. (2012). Sengsara akibat diabetes. Ruangan Kesihatan, ms 17. 10 Jun 2012.
- Mlynarczyk, S.M. (2013). Adolescents' Perspectives of Parental Practices Influence Diabetic Adherence and Quality of Life. *Paediatric Nursing*. 39(4): 181-189.
- Mohamad Saleh, S., Azahari, M. H. & Ismail, A. I. (2013). Diabetic Healthcare Awareness in Malaysia: The Role of Poster as a Communication Medium. *Procedia - Social and Behavioral Sciences* 91(2013): 539–544.
- Mohamed, I.S. (2019). Tahap kesedaran bahaya NCD rendah. *Berita Harian*. 7 Ogos: 5.
- Mohd Ali, A.F. (2016). 3.5 juta rakyat hidap diabetes. *Utusan*. 8 April: 6.
- Mohd Najib, M.N., Dali, A.F., Ahmad, A., Sulaiman, S., Hussin, S.N. & Mokhtar, N.A. (2014). Knowledge and Attitude on Diabetes Among Public In Kota Bharu Kelantan, Malaysia. *International Journal of Education and Research*. 2(2): 1-10.

- Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F. & Bales VVS. (2001). Prevalence of obesity, diabetes, and obesity-related health risk-factors. *JAMA The Journal of the American Medical Association*. 289(10):76–9.
- Mooi, E.A., & Sarstedt, M. (2011). *A concise guide to market research: The process, data, and methods using IBM SPSS Statistics*. Berlin: Springer.
- Moritz, S., Hünsche, A. & Lincoln, T.M. (2014). Nonadherence to antipsychotics: The role of positive attitudes towards positive symptoms. *European Neuropsychopharmacology*. 24: 1745–1752.
- Moseley, M. (2000). Teaching for environmental literacy. *Clearing House*. 74(1): 23-24.
- Mostafa, M.M. (2005). An empirical study of patients' expectation and satisfaction in Egyptian hospitals. *International Journal of Health Care Quality Assurance*. 18(7): 516-532.
- Mustaffa, B.E. (2004). Diabetes Epidemic in Malaysia. *Medical Journal of Malaysia*. 59(3): 295-296.
- Mustaffa B.E. (1999). Diabetes in Malaysia: a challenge to prevention and control. *J Asian Fed Endocr Soc*. 17:44–7.
- Mustaffa Embong. (1990). Diabetes in Malaysia: Problems and challenges. *Med. J. Malaysia*. 45(1): 1-7.
- Murugesan, N., Snehalatha, C., Shobhana, R., Roglic, G. & Ramachandran, A. (2007). Awareness about diabetes and its complications in the general and diabetic population in a city in southern India. *Diabetes Research and Clinical Practice*. 77: 433–437.
- Nadia H. (2012). Berita Harian. Kesedaran pesakit penting. Ruangan sihat. Ms 14-15. 14 Oktober 2012.
- National Health and Medical Research Council. (2001). *National Evidence Based Guidelines for the Management of Type 2 Diabetes Mellitus*. Sydney: Australian Centre for Diabetes Strategies.
- Ng, S.H., Chan, K.H., Lian, Z.Y., Chuah, Y.H., Waseem, A.N. & Kadirvelu, A. (2012). Reality vs Illusion: Knowledge, Attitude and Practice among Diabetic Patients. *International Journal of Collaborative Research on Internal Medicine & Public Health*. 4(5): 723-732.
- Nisar, N., Ahmad Khan, I., Qadri, M.H. & Sher, S.A. (2008). Knowledge and risk assessment of diabetes mellitus at primary care level: a preventive approach required combating the disease in a developing country. *Pak J Med Sci*. 24(5): 667-72.
- Nizar, H. (2017). Program 'Blue Walk' untuk kesedaran penyakit diabetes. *Utusan*. 12 November: 4.

- Norliza, A., Maizah Hura, A. & Robiah, A. (2006). A comparative study on some methods for handling multicollinearity problems. *Matematika* 22(2): 109-119.
- Norzaidi, M.D. & Intan Salwani, M. (2009). Evaluating technology resistance and technology satisfaction on students performance. *Campus-Wide Information Systems* 26(4): 298-312.
- Nunnally, J.C. (1978). *Psychometric Theory*. New York: McGraw-Hill.
- O'Brien, M. P., Gordon, J. L., Bearden, C. E., Lopez, S. R., Kopelowicz, A. & Cannon, T. D. (2006). Positive family environment predicts improvement in symptoms and social functioning among adolescents at imminent risk for onset of psychosis. *Schizophrenia Research*. 81 (2006): 269– 275.
- Ogden, C., Carroll, M., Curtin, L., McDowell, M. & Flegal, K. (2006). Prevalence of overweight and obesity in the United States, 1999-2008. *JAMA: Journal of the American Medical Association* 295: 1549-1555.
- Okosun, I.S., Davis-Smith, M. & Seale, J.P. (2012). Awareness of diabetes risks is associated with healthy lifestyle behavior in diabetes free American adults: evidence from a nationally representative sample. *Primary Care Diabetes*. <http://dx.doi.org/10.1016/j.pcd.2011.12.005>.
- Oliveira, S.C., Santos, A.A. & Pavarini, S.C.I. (2014). The relationship between depressive symptoms and family functioning in institutionalized elderly. *Rev Esc Enferm USP*. 48(1): 65-71.
- Omobuwa, O. & Alebiosu, O.C. (2014). Awareness of diabetes amongst undergraduates in a Nigerian University, South West Nigeria. *Sahel Medical Journal*. 17(1): 29-33.
- Omondi, D.O., Walingo M.K., Mbagaya G.M. & Othuon L.O.A. (2010). Understanding Physical Activity Behavior of Type 2 Diabetics Using the Theory of Planned Behavior and Structural Equation Modeling. *International Journal of Human and Social Sciences*. 5(3): 160-167.
- Ooyub, S., Ismail, F. & Daud, N. (2004). Diabetes program in Malaysia—current and future. *NCD Malaysia*. 3: 6–12.
- Pallant, J. (2011). *SPSS survival manual: A step by step guide to data analysis using SPSS*. 4th Edition. NSW, Australia: Allen & Unwin.
- Park, S., Kim, B. & Park, M. (2016). The relationship between parenting attitudes, negative cognition, and the depressive symptoms according to gender in Korean adolescents. *International Journal of Mental Health Systems*. 10(35): 1-8.
- Pasala, S.K., Rao, A.A. & Sridhar. G.R. (2010). Built environment and diabetes. *Int J Diab Dev Ctries*. 30(2): 63-68.
- Patel, V., Koshy, S. & Ravindra, H.N. (2014). Effectiveness of structured teaching programme on knowledge regarding menopausal symptoms and its management among women. *IOSR J Nurs Health Sci*. 3: 22-6.

- Peng, D.X., Schroeder, R.G. & Shah, R. (2008). Linking routines to operations capabilities: A new perspective. *Journal of Operations Management* 26: 730-748.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y. & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology*. 88(5): 879-903.
- Podsakoff, P.M. & Organ, D.W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management* 12(4): 531-544.
- Poornima, S., Ragavendra, L. & Shivakumar, K.M. (2012). Awareness regarding diabetes mellitus among degree college students of Mandya City, Karnataka, India. *Indian J. Prev. Soc. Med.* 43(3):283-287.
- Prajapati, V. B., Blake, R., Acharya, L. D. & Seshadri, S. (2018). Assessment of quality of life in type II diabetic patients using the modified diabetes quality of life (MDQoL)-17 questionnaire. *Brazilian Journal of Pharmaceutical Sciences*, 53(4).
- Preston, C.C. & Colman, A.M. (2000). Optimal number of response categories in rating scales: Reliability, validity, discriminating power, and respondent preferences. *Acta Psychologica*. 104: 1-15.
- Raheja, B.S., Kapur, A., Bhoraskar, A., Sathe, S.R., Jorgensen, L.N. & Moorthi, S.R. (2001). Diab Care Asia-India Study: Diabetes care in India-Current status. *J Assoc Physicians India*. 49: 717-22.
- Rahim, M.A. & Magner, N.R. (1995). Confirmatory factor analysis of the styles of handling interpersonal conflict: First-order factor model and its invariance across groups. *Journal of Applied Psychology* 80(1): 122-132.
- Ramachandran, A. (2014). Know the signs and symptoms of diabetes. *Indian J Med Res.* 140(5): 579-581.
- Ramachandran, A., Snehalatha, C., Baskar, A.D., Mary, S., Kumar, C.K. & Selvam, S. (2004). Temporal changes in prevalence of diabetes and impaired glucose tolerance associated with lifestyle transition occurring in the rural population in India. *Diabetologia*. 47: 860-5.
- Ramachandran, A., Snehalatha, C., Mary, S., Mukesh, B., Bhaskar, A.D. & Vijay, V. (2006). Indian Diabetes Prevention Programme (IDPP). The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1). *Diabetologia*. 49(2): 289-97.
- Ramayah, T., Lee, J.W.C. & In, J. B.C. (2011). Network collaboration and performance in the tourism sector. *Service Business*. 5(4): 411-428.
- Ramayah, T., Yeap, J. A. & Ignatius, J. (2013). An Empirical Inquiry on Knowledge Sharing Among Academicians in Higher Learning Institutions. *Minerva*. 51(2):131-154.

- Ranjini, A., Subashini, A. & Ling, H.M. (2003). A Knowledge, attitude and practice (KAP) study of diabetes mellitus among patients attending Klinik Kesihatan Seri Manjung. *NCD Malaysia*. 2(2): 6-16.
- Rathod, G.B., Rathod, S., Parmar, P. & Parikh, A. (2014). Study of knowledge, attitude and practice of general population of Waghodia towards diabetes mellitus. *Int J Cur Res Rev*. 6(1): 63-68.
- Rav-Marathe, K., Wan, K.T.H. & Marathe, S. (2016). A Systematic Review on The KAP-O Framework For Diabetes Education And Research. *Medical Research Archives*. 4(1): 1-21.
- Razali, N.M. & Wah, Y.B. (2011). Power comparisons of shapiro-wilk, kolmogorov-smirnov, lilliefors and Anderson-darling tests. *Journal of Statistical Modeling and Analytics*. 2(1): 21-33.
- Reed M.C. & Tu H.T. (2002). Triple jeopardy: low income, chronically ill and uninsured in America. Issue Brief Cent Stud Health Syst Change. 49:14. <http://www.hschange.org/CONTENT/411/411.pdf>
- Ringle, C.M., Wende, S. & Will, A. (2005). SmartPLS 2.0 M3. www.smartpls.de.
- Robby K. (2012). Correlation of Selenium and other antioxidants in diabetic patients with and without complications. Free Radicals and Antioxidants Vol. 2, Issue 1. for Diabetic Ketoacidosis. The Journal of Pediatrics, 160, 4.
- Rolka, M.S., Burrows, N.R., Li, Y. & Geiss, L.S. (2008). Self-reported prediabetes and risk reduction activities—United States, 2006. MMWR Morbidity and Mortality Weekly Report. 57(44): 1203-5.
- Roth, C.E. (1992). Environmental Literacy: Its Roots, Evolution and Directions in the 1990s. Ohio: Clearinghouse for Science, Mathematics and Environmental Education.
- Rouibah, K., Ramayah, T. & May, O.S. (2011). Modeling user acceptance of internet banking in Malaysia: A partial least square (PLS) approach. Dlm. Sharma, S.K. (pnyt.). *E-adoption and Socio-Economic Impacts: Emerging Infrastructural Effects*, hlm. 1-23. IGI Global: DOI: 10.4018/978-1-60960-597-1.ch001.
- Saadat N., Salehi P., Emami H. & Azizi, F. (2005). The Relationship between Glucose Intolerance and Blood Pressure, Body Mass Index, and Waist to Hip Ratio in Tehran Urban Population: "Tehran Lipid and Glucose Study". *International Journal of Endocrinology and Metabolism* 1: 37-47.
- Sadat, N., Siraj, M.D., Omar, Z.A., Samad, M.I., Ismail, F., Daud, N.A., Kamarudin, A.S., Ishak, J., Ramly, R., Roslina, N.M., Jailani, R., Rajalakshimi, K., Usha, M., Arshad, J., Ismail, S., Said, S.H., Nizam, S., Anizah, A. & Lan, H.S. (2003). Direct costs of diabetes in an outpatient setting in Malaysia. *NCD Malaysia*. 2003; 2: 19-27.

- Sagaran, R. & Srinivasan, N. (2014). Public awareness of diabetes mellitus in Klang district, Selangor. *International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)*. 2(3): 186-195.
- Sang S.L., Lee J.D. & Lee J. (2010). E-government adoption in Cambodia: A partial least squares approach. *Transforming Government: People, Process and Policy* 4(2): 138-157.
- Satibi, Z. (2017). Rawatan murah diabetes. *MyMetro*. 15 January: 8.
- Sattler, H., Volckner, F., Riediger, C. & Ringle, C.M. (2010). The impact of brand extension success drivers on brand extension price premiums. *International Journal of Research in Marketing* 27: 319-328.
- Schmidt, S., Muhlan, H. & Power, M. (2005). The EUROHIS-QOL 8-item index: Psychometric results of a cross-cultural field study. *European Journal of Public Health* 16(4): 420-428.
- Schober, E., Otto, K.P., Dost, P., Jorch N. & Holl, R. (2011). Association of Epilepsy and Type 1 Diabetes Mellitus in Children and Adolescents: Is There an Increased Risk for Diabetic Ketoacidosis. *The Journal of Pediatrics*. 160, 4.
- Schumacker, R.E. & Lomax, R.G. (2004). *A Beginner's Guide to Structural Equation Modeling*. New Jersey: Lawrence Erlbaum Associates.
- Second national health and morbidity survey. (1996). Malaysia: Institute of Public Health, Ministry of Health; 1996.
- Sekaran, U. (2006). *Research Methods for Business*. 4th ed. New York: John Wiley & Sons.
- Sekaran, U. & Bougie, R. (2010). *Research Methods for Business: A skill Building Approach*. UK: John Wiley and Sons.
- Sepp E., Kolk H., Loivukene K. & Marika M. (2014). Higher blood glucose level associated with body mass index and gut microbiota in elderly people. *Microbial Ecology in Health & Disease* 25: 1-8.
- Shah, R. & Goldstein, S.M. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management* 24: 148-169.
- Shriraam, V., Rani, M.A., Sathiyasekaran, B.W.C. & Mahadevan, S. (2013). Awareness of gestational diabetes mellitus among antenatal women in a primary health center in South India. *Indian Journal of Endocrinology and Metabolism*. 17(1): 146-148.
- Sidek, M.N. (2002). *Rekabentuk Penyelidikan: Falsafah, Teori dan Praktis*. Serdang: Penerbit Universiti Putra Malaysia.

- Sidek, M.N & Wan Marzuki, W.J. (2007). Analisis kesahan dan kebolehppercayaan inventori penilaian kaunselor terhadap penyelia (IPKtP). *Jurnal PERKAMA* 13: 1-13.
- Siti Aishah, H. & Kaseh, A.B. (2008). Exploratory versus confirmatory factor analysis. *Seminar Penyelidikan dan Pembangunan Sumber Manusia 2008*. Faculty of Educational Studies, UPM.
- Skarfors E.T., Selinus K.I. & Lithell H.O. (1991). Risk factors for developing noninsulin dependent diabetes: a 10 year follow up of men in Uppsala. *BMJ* 303: 755-60.
- Soltanian, A.R., Bahreini, F. & Mohammad Afkhami-Ardekani, M.A. (2007). People awareness about diabetes disease and its complications among aged 18 years and older in Bushehr port inhabitants (Iran). *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. (2007)1: 245—249.
- Soyed, S.A., Das, S. & Begum, T. (2005). Foot Involvement in diabetes mellitus. *Asian J Diabetology*. 7(1): 15–24.
- Spitznagel, M.B., Tremont, G., Brown, L.B. & Gunstad, J. (2006). Cognitive Reserve and the Relationship Between Depressive Symptoms and Awareness of Deficits in Dementia. *J Neuropsychiatry Clin Neurosci*. 18(2): 186-190.
- Stahl F. & Johansson R. (2009). Diabetes mellitus modelling and short-term prediction based on blood glucose measurements. *Mathematical Biosciences* 217(2009): 101-117.
- Stanford, J., Kaiser, M., Ablah, E., Dong, F., Paull-Forney, B. & Early, J. (2012). The effect of weight loss on fasting blood sugars and hemoglobin A1c in overweight and obese diabetics and non-diabetics. *Journal of Diabetes Mellitus* 2(1): 126-130.
- Steyn, N.P., Mann, J., Bennett, P.H., Temple, N., Zimmet, P. & Tuomkhito, J. (2004). Diet, nutrition and the prevention of type 2 diabetes. *Public Health Nutrition*. 7(19): 147–65.
- Stone M. (1974). Cross-validator choice and assessment of statistical predictions. *Journal of the Royal Statistical Society* 36(2): 111–147.
- Suhr, D. D. (2002). SEM for health, business, and education. *Proceedings from the 27th Annual SAS® Users Group International Conference*. April 14-17, Orlando, Florida.
- Suzan, A. (2012). Menangani terapi insulin. Ruangan sihat. *Berita Harian*. Ms 14. 4 Nov 2012.
- Tan S.L., Juliana S. & Sakinah H. (2011). Dietary Compliance and its Association with Glycemic Control among Poorly Controlled Type 2 Diabetic Outpatients in Hospital Universiti Sains Malaysia. *Malaysian Journal of Nutrition*. 17(3): 287-299.

- Tanjia, N., Fannana, T., Ahmed Naved, M. & Sultana, S. (2016). Assessing the Knowledge, Attitude and Practice of Diabetes Mellitus among Diabetes Patients in Dhaka City, Bangladesh. *J Pharm Chem Biol Sci.* 4(1): 64-75.
- Teck-Hong, T. & Suhaimi, F. (2014). Assessing Diabetes Education and Self-Management Program on Quality of Life among Young Diabetic Patients: Case of Klang Valley, Malaysia. *Australian Journal of Basic and Applied Sciences.* 8(7): 352-359.
- Tenenhaus, M., Vinzi, V.E., Chatelin, Y.M. & Lauro, C. (2005). PLS path modeling. *Computational Statistics and Data Analysis* 48: 159-205.
- Tesfaye S., Chaturvedi N., Eaton S., Ward J., Manes C. & Ionescu-Tirgoviste, C. (2005). Vascular risk factors for diabetic neuropathy. *New England Journal of Medicine* 352: 341-350.
- Trikkalinou, A., Papazafiropoulou, A.K. & Melidonis, A. (2017). Type 2 diabetes and quality of life. *World J Diabetes.* 8(4): 120-129.
- Tuomilehto, J., Lindstrom, J., Eriksson, J.G., Valle, T.T., Hamalainen, H. & Ilanne-Parikka, P. (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New England Journal of Medicine.* 344: 1343–50.
- Turkylmaz, A. & Ozkan, C. (2007). Development of a customer satisfaction index model: An application to the Turkish mobile phone sector. *Industrial Management & Data Systems* 107(5): 672-687.
- Ullman, J.B. (2001). Structural equation modeling. In B. G. Tabachnick, & L. S. Fidell (4th Ed.), *Using multivariate statistics* (pp.653-771). Needham Heights, MA: Allyn & Bacon.
- Van der Sande, M.A., Walraven, G.E., Milligan, P.J., Banya, W.A., Ceesay, S.M., Nyan, O.A. & McAdam, K.P. (2001). Family history: an opportunity for early interventions and improved control of hypertension, obesity and diabetes. *Bull World Health Organ.* 79: 321–328.
- Van Eijk, K.N.D., Bloma, J. Gussekloo, B.C.P. Polak, Y. & Groeneveld. (2012). Diabetic retinopathy screening in patients with diabetes mellitus in primary care: Incentives and barriers to screening attendance. *Diabetes Research and Clinical Practice*, 96, 10 – 16.
- Veghari G., Sedaghat M., Joshaghani H., Banihashem S., Moharloe P., Angizeh A., Tazik E., Moghaddami A., Hajian-Tilaki K. & ZahedPasha, Y. (2014). The association of fasting blood glucose (FBG) and waist circumference in northern adults in Iran: a population based study. *Journal of Diabetes & Metabolic Disorders* 13(2): 1-6.
- Vinzi V. E. (2010). *Handbook of partial least squares: Concepts, methods and applications.* Springer.

- Volckner, F., Sattler, H., Hennig-Thurau, T. & Ringle, C.M. (2009). The role of parent brand quality for service brand extension success. *Journal of Service Research* DOI: 10.1177/1094670510370054.
- Walter, F.M., Emery, J., Braithwaite, D. and Marteau, T.M. (2004). Lay understanding of familial risk of common chronic diseases: a systematic review and synthesis of qualitative research. *Ann Fam Med*. 2(6): 583–94.
- Wan Muhamad A. & Norizan M. (2012). Influence of Hypertension and Diabetes Mellitus on Family History of Heart Attack in Male Patients. *Applied Mathematical Sciences*. 6(66): 3259-3266.
- Wang, R., L., Wu & Hsu, H. (2011). A Path Model of Health-Related Quality of Life in Type 2 Diabetic Patients: A Cross-Sectional Study in Taiwan. *Journal of Advanced Nursing*. 67(12): 2658-2667.
- Wee, H.L., Ho, H.K. & Li, S.C. (2002). Public awareness of diabetes mellitus in Singapore. *Singapore Med J*. 2002: 128–34.
- Weijters, B., Cabooter, E. & Schillwaert, H. (2010). The effect of rating scale format on response styles: The number of responses categories and response category labels. *International Journal of Research in Marketing*. 27: 236-247.
- Westlund, A.H., Kallstrom, M. & Parmler, J. (2008). SEM-based customer satisfaction measurement: On multicollinearity and robust PLS estimation. *Total Quality Management and Business Excellence* 19(7-8): 855-869.
- Wild, S., Roglic, G., Green, A., Sicree, R. & King, H. (2004). Global prevalence of diabetes: Estimates for the year 2000 and projections for 2030. *Diabetes Care*, 27(5), 1047-1053.
- Wing, R., Goldstein, M.G., Acton, K.J., Birch, L.L., Jakicic, J.M. & Sallis, J.F. (2001). Behavioral science research in diabetes: lifestyle changes related to obesity, eating behavior, and physical activity. *Diabetes Care*. 24(1):117–23.
- Wong K.K. (2013). Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS. *Marketing Bulletin* 24, Technical Note 1. 1- 32.
- Wong T., Klein R. & Islam, F.E. (2006). Diabetic retinopathy in a multi-ethnic cohort in the United States. *American Journal of Ophthalmology* 141: 446.
- Yun, L.S., Hassan, Y., Abd. Aziz, N., Awaisu, A. & Ghazali, R. (2007). A comparison of knowledge of diabetes mellitus between patients with diabetes and healthy adults: A survey from north Malaysia. *Patient Education and Counseling*. 69: 47-54.
- Zakaria, M.Q. (2013). Segera Ubah Gaya Hidup. *Utusan Malaysia*. 5 November, 9.
- Zinman B., Harris S.B., Gerstein H.C., Young T.K., Raboud J.M. & Neuman J. (2006). Preventing type 2 diabetes using combination therapy: design and methods of the Canadian Normoglycaemia Outcomes Evaluation (CANOE) trial. *Diabetes Obesity and Metabolism* 2006 8(5): 531–7.